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Technical analysis of the first biennial update report of China submitted on 12 January 2017

Summary report by the team of technical experts

Summary

According to decision 2/CP.17, paragraph 41(a), Parties not included in Annex I to the Convention (non-Annex I Parties), consistent with their capabilities and the level of support provided for reporting, were to submit their first biennial update report (BUR) by December 2014. Further, paragraph 41(f) of that decision states that non-Annex I Parties shall submit a BUR every two years, either as a summary of parts of their national communication in the year in which the national communication is submitted or as a stand-alone update report. As mandated, the least developed country Parties and small island developing States may submit BURs at their discretion. This summary report presents the results of the technical analysis of the first BUR of China conducted by a team of technical experts in accordance with the modalities and procedures contained in the annex to decision 20/CP.19.

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I. Introduction and process overview

A. Introduction

1. The process of international consultation and analysis (ICA) consists of two steps: the technical analysis of the submitted biennial update report (BUR), resulting in a summary report for each BUR analysed, followed by a workshop for the facilitative sharing of views under the Subsidiary Body for Implementation.

2. According to decision 2/CP.17, paragraph 41(a), Parties not included in Annex I to the Convention (non-Annex I Parties), consistent with their capabilities and the level of support provided for reporting, were to submit their first BUR by December 2014.

3. Further, according to paragraph 58(a) of the same decision, the first round of ICA is to be conducted for non-Annex I Parties commencing within six months of the submission of the Parties' first BURs. The frequency of developing country Parties' participation in subsequent rounds of ICA, depending on their respective capabilities and national circumstances, and the special flexibility for small island developing States and the least developed country Parties, will be determined by the frequency of the submission of BURs.

4. This summary report presents the results of the technical analysis of the first BUR of China undertaken by a team of technical experts (TTE) in accordance with the provisions on the composition, modalities and procedures of the TTE under ICA contained in the annex to decision 20/CP.19.

B. Process overview

5. China submitted its first BUR on 12 January 2017. In its BUR, China reported that funds to prepare its BUR were received from the Global Environment Facility (GEF) in 2015, further to which it began the preparation of its BUR.

6. The technical analysis of the BUR took place from 22 to 26 May 2017 in Bonn, Germany, and was undertaken by the following TTE, drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Ms. Ruleta Camacho Thomas (former member of the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention from Antigua and Barbuda), Ms. Helen Plume (New Zealand), Mr. Ioannis Sempos (Greece), Ms. Anna Sikharulidze (Georgia), Mr. Ching Tiong Tan (Malaysia) and Mr. Jongikhaya Witi (South Africa). Ms. Plume and Mr. Witi were the co-leads. The technical analysis was coordinated by Ms. Alma Jean, Mr. Sohel Pasha and Mr. Marlan Pillay (secretariat).

7. During the technical analysis, in addition to the written exchange, through the secretariat, to provide technical clarifications on the information reported in the BUR, the TTE and China engaged in consultation on the identification of capacity-building needs for the preparation of BURs and participation in the ICA process. Following the technical analysis of China's first BUR, the TTE prepared and shared a draft summary report with China on 11 August 2017 for its review and comment. China, in turn, provided its feedback on the draft summary report on 10 November 2017.

8. The TTE responded to and incorporated the Party's comments referred to in paragraph 7 above and finalized the summary report in consultation with China on 28 March 2018.

II. Technical analysis of the biennial update report

A. Scope of the technical analysis

9. The scope of the technical analysis is outlined in decision 20/CP.19, annex, paragraph 15, according to which the technical analysis aims to, without engaging in a discussion on the appropriateness of the actions, increase the transparency of mitigation actions and their effects, and shall entail the following:

(a) The identification of the extent to which the elements of information listed in paragraph 3(a) of the ICA modalities and guidelines (decision 2/CP.17, annex IV) have been included in the BUR of the Party concerned (see chapter II.B below);

(b) A technical analysis of the information reported in the BUR, specified in the "UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention" (hereinafter referred to as the UNFCCC reporting guidelines on BURs) (decision 2/CP.17, annex III), and any additional technical information provided by the Party concerned (see chapter II.C below);

(c) The identification, in consultation with the Party concerned, of capacity-building needs related to the facilitation of reporting in accordance with the UNFCCC reporting guidelines on BURs and to participation in ICA in accordance with the ICA modalities and guidelines, taking into account Article 4, paragraph 3, of the Convention (see chapter II.D below).

10. The remainder of this chapter presents the results of each of the three parts of the technical analysis of China's BUR outlined in paragraph 9 above.

B. Extent of information reported

11. The elements of information referred to in paragraph 9 (a) above include: the national greenhouse gas (GHG) inventory report; information on mitigation actions, including a description of such actions, an analysis of their impacts and the associated methodologies and assumptions, and the progress made in their implementation; information on domestic measurement, reporting and verification (MRV); and information on support needed and received.

12. According to decision 20/CP.19, annex, paragraph 15(a), in undertaking the technical analysis of the submitted BUR, the TTE is to identify the extent to which the elements of information listed in paragraph 11 above have been included in the BUR of the Party concerned. The TTE considers that the reported information is mostly consistent with the UNFCCC reporting guidelines on BURs. Specific details on the reporting on each of the required elements are provided in annex I.

C. Technical analysis of the information reported

13. The technical analysis referred to in paragraph 9(b) above aims to increase the transparency of mitigation actions and their effects, without engaging in a discussion on the appropriateness of those actions. Accordingly, the technical analysis focused on the transparency of the information reported in the BUR.

14. For information reported on national GHG inventories, the technical analysis also focused on the consistency of the methods used for preparing those inventories with the appropriate methods developed by the Intergovernmental Panel on Climate Change (IPCC) and referred to in the UNFCCC reporting guidelines on BURs.

15. The results of the technical analysis are presented in the remainder of this chapter. The main results (sections II/C.1 to II.C.6) cover mainland China, and section II.C.7 reports the results for Hong Kong Special Administrative Region (HKSAR) and Macao Special Administrative Region (Macao SAR).

1. Information on national circumstances and institutional arrangements relevant to the preparation of national communications on a continuous basis

16. As per the scope defined in paragraph 2 of the UNFCCC reporting guidelines on BURs, the BUR should provide an update to the information contained in the most recently submitted national communications, including, among other things, information on national circumstances and institutional arrangements relevant to the preparation of national communications on a continuous basis. In their national communications, non-Annex I Parties report on their national circumstances following the reporting guidance contained in decision 17/CP.8, annex, paragraphs 3–5.

17. In accordance with decision 17/CP.8, annex, paragraph 3, China reported in its first BUR, the following information on national circumstances: a description of national and regional development priorities, objectives and circumstances, including information on features of geography, climate and economy that may affect the ability to deal with mitigating and adapting to climate change, as well as information regarding national circumstances and constraints on their specific needs and concerns arising from the adverse effects of climate change and/or the impact of the implementation of response measures, as referred to in Article 4, paragraph 8, and, as appropriate, in Article 4, paragraphs 9 and 10, of the Convention.

18. China reported in its BUR that it is a developing country with medium economic development level and that this represents an upper-middle income country according to the World Bank standard, and that its economic structure is still experiencing a transition. Compared with 2010, its primary and secondary industries have declined by 0.4 per cent and 3.3 per cent, respectively, and tertiary industry has experienced an increase of 3.7 per cent. China also reported that it is the most populous country in the world, and that by the end of 2014 its total population was 1.368 billion. In its BUR, mainland China is described as having a complex and diverse climate, geography and ecosystems, which are subject to adverse impacts of severe climatic disasters that have caused significant economic losses. The report states that mainland China is simultaneously faced with multiple challenges of economic development, poverty elimination, livelihood enhancement, environmental protection and climate change responses.

19. In addition, as encouraged in decision 17/CP.8, annex, paragraph 4, China provided a summary of relevant information regarding its national circumstances in tabular format.

20. China transparently described in its first BUR the existing institutional arrangements relevant to the preparation of its national communications and BURs on a continuous basis for mainland China. The description covers the preparation and submission of national communications and BURs on a continuous basis, and identifies the legal status and roles and responsibilities of the overall coordinating entity and the involvement and roles of other institutions and experts for the preparation of the GHG inventory. The information reported in the BUR indicates that, in June 2007, the Chinese Government decided to set up the National Leading Group on Climate Change, Energy Conservation and Emission Reduction (hereinafter referred to as the Leading Group), which performs the dual roles of national deliberation and coordination and also reviewed and submitted China's nationally determined contribution (NDC). The Leading Group Office is based at National Development and Reform Commission (NDRC), with participation of ministerial members including the Ministry of Foreign Affairs, Ministry of Environmental Protection and Ministry of Finance, as illustrated in figure 1–1 of the BUR. The provincial governments have also established their respective leading groups.

21. The NDRC is responsible for organizing the preparation of the third national communication and first BUR of China, including the national GHG inventories for 2010 and 2012. To enhance strategic research and institutional cooperation related to climate change, China reports that the National Centre for Climate Change Strategy and International Cooperation (NCSC) was established in 2012 and it is based under the NDRC. The main responsibilities of NCSC are the organization of research projects on policies, regulations and planning for China to address climate change. China also reported on its efforts and plans for the improvement of the institutional mechanism for addressing climate

change, which include plans for building capacity to improve public awareness and the MRV system, at the local and regional levels.

2. National greenhouse gas emissions by sources and removals by sinks

22. As indicated in table 1, in annex I, China reported information on its GHG inventory in its BUR, mostly in accordance with paragraphs 3–10 of the UNFCCC reporting guidelines on BURs and paragraphs 8–24 of the "Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention", contained in the annex to decision 17/CP.8.

23. China completed its first BUR in 2016, but submitted it to the secretariat in January 2017; the GHG inventory reported is for the year 2012, which is consistent with the requirements of the reporting time frame.

24. GHG emissions and removals for the 2012 inventory were estimated using methodologies from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) as appropriate. The particular IPCC guidance documents used to prepare the GHG inventory for the different sectors were not clearly reported. During the technical analysis, China clarified that it used the IPCC good practice guidance in the inventory for nitric acid production, adipic acid production, consumption of perfluorocarbons (PFCs), and carbon dioxide (CO_2) emissions from waste incineration. Further, the 2006 IPCC Guidelines was used in the inventory for: ammonia production; soda ash production; ferroalloys production; sulphur hexafluoride (SF_6) used in magnesium foundries, lead production and zinc production; consumption of hydrofluorocarbons (HFCs) in refrigeration and air-conditioning equipment; consumption of SF_6; methane (CH_4) emissions from rice cultivation; and CH_4 and nitrous oxide (N_2O) emissions from waste incineration. The Revised 1996 IPCC Guidelines were applied for all other sectors. The TTE noted that the transparency of the information reported on emissions and removals could be enhanced by providing information in the BUR on which of the IPCC guidelines were applied in different parts of the GHG inventory.

25. With regard to the methodologies used, information was reported transparently on the tier levels and sources of activity data (AD) used for each category and subcategory, except for the specific AD of all land-use change and forestry (LUCF) categories. Information was not reported on which of the IPCC guidelines were used for the methodologies and the default emission factors (EFs), or brief explanations of the sources of country-specific EFs. During the technical analysis, China clarified which of the IPCC guidelines were used for different parts of the GHG inventory (see para. 24 above). The TTE noted that the transparency of the information reported on emissions and removals could be further enhanced by providing information on AD for the LUCF sector and sources of EFs in the BUR, in particular for the country-specific EFs used in all sectors.

26. The total GHG emissions for 2012 reported in the BUR, including and excluding LUCF, amounted to 11,320 million tonnes of carbon dioxide equivalent (Mt CO_2 eq) and 11,896 Mt CO_2 eq, respectively. Excluding LUCF, the most significant contribution was from the energy sector, amounting to 78.5 per cent of the total national emissions, followed by the industrial processes sector, the agriculture sector and the waste sector, amounting to 12.3 per cent, 7.9 per cent and 1.3 per cent, respectively. Information was also reported on the GHG emissions on a gas-by-gas basis for the same year, excluding the LUCF sector. The CO_2 emissions amounted to 9,893 Mt CO_2 eq, with the energy sector contributing 87.8 per cent of CO_2 emissions (8,688 Mt); CH_4 emissions amounted to 1,174 Mt CO_2 eq, with the energy sector contributing, 49.3 per cent of the CH_4 emissions; N_2O emissions amounted to 638 Mt CO_2 eq, with the agriculture sector accounting for 71.6 per cent of the total N_2O emissions. China reported emissions of HFCs, PFCs and SF_6. In 2012, the total emissions of these gases were reported as 191 Mt CO_2 eq, with the primary source being the industrial processes sector.

27. China reported its GHG inventories for 1994 and 2005, which were included in its first and second national communications, and reported that the data in the 2005 inventory will be recalculated and updated and included in its third national communication. The total emissions reported in the BUR, in 1994, including and excluding LUCF amounted to 3,650 Mt CO_2 eq and 4,057 Mt CO_2 eq, respectively. In 2005, the total emissions including and excluding LUCF are reported as 7,046 Mt CO_2 eq and 7,467 Mt CO_2 eq, respectively. In 1994 and in 2005 CO_2 contributed respectively 73.1 per cent and 78.8 per cent of the total emissions including LUCF. The respective amounts for CO_2 excluding LUCF are 75.8 per cent and 80.0 per cent. LUCF accounted for removals of 407 Mt CO_2 eq in 1994 and 421 Mt CO_2 eq in 2005.

28. In its BUR, China did not report on any of the indirect GHGs. During the technical analysis, China clarified that this was due to high uncertainties in data, and that it plans to conduct some case studies aimed at enhancing its capacity to report on these gases. China used the notation key "NE" (not estimated) for some categories, such as for CH_4 emissions for the category chemical industry and N_2O emissions from metal production, but did not report any further information on its use of notation keys. The TTE noted that, consistent with IPCC guidance, reporting the above information on the rationale for using the notation key "NE" for these categories would further enhance the transparency of information reported for the GHG inventory. Information on the solvent and other product use sector and the category prescribed burning of savannahs in the agriculture sector was not reported in table 2-9 of the BUR, where China reported its GHG emissions by sources and sinks, although reporting of this information is contained in decision 17/CP.8, annex, table 1. During the technical analysis, China clarified that there are only indirect GHG emissions from the solvent and other product use sector, and that savannahs are non-existent in China, and as such, this information was not reported. The TTE noted that reporting these sectors/categories and using notation keys, as appropriate, in line with IPCC guidance, would also further enhance the transparency of the information reported for the GHG inventory.

29. China reported some of the information outlined in the sectoral reporting tables annexed to the Revised 1996 IPCC Guidelines, but did not report the information addressed in the tables included in annex 3A.2 to the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). However, China reported: sector-level AD for the industrial processes, agriculture and waste sectors; some aggregated LUCF information; and data references for AD from the energy sector. During the technical analysis, China clarified that the LUCF AD are the latest national forest resources inventory data from the State Forestry Administration. Further, China clarified that, given the quantity of AD available in the energy sector, only aggregated coal, oil and natural gas consumption data was provided and that additional detailed information will be provided in its third national communication. The TTE noted that reporting detailed AD for all sectors, the full sectoral coverage of the sectoral reporting tables annexed to the Revised 1996 IPCC Guidelines, and the information addressed in the tables included in annex 3A.2 to the IPCC good practice guidance for LULUCF, would enhance the transparency of the information reported in the BUR.

30. GHG emissions in 2012 from the energy sector amounted to 9,337 Mt CO_2 eq with fuel combustion being the most significant source of GHG emissions, amounting to 8,813 Mt CO_2 eq, or 94.4 per cent of the energy sector. Compared with the 2005 inventory some new information has been added, including CH_4 emissions from energy industries, and CH_4 and N_2O emissions from manufacturing and construction. The TTE commends China for these improvements in completeness.

31. Industrial process emissions amounted to 1,463 Mt CO_2 eq, with emissions estimated for mineral products, chemical industry and metal production as well as from the production and consumption of halocarbons and SF_6. The most significant source was from mineral products, accounting for 57 per cent of total emissions. Information was not reported on the GHG emission estimates for the solvent and other product use sector and there was no further clarification as to why some emissions of HFCs and SF_6 were reported as "NE". During the technical analysis China clarified that it plans to expand the coverage

of HFCs in the future if the data are available. The TTE noted that including this information in the BUR would further enhance the transparency of information reported on the GHG inventory.

32. For the agriculture sector, China reported GHG emissions of 938 Mt CO_2 eq, with N_2O from agricultural soils being the largest contributing emission source in the sector, amounting to 378 Mt CO_2 eq or 40.3 per cent of the total. China used a mixture of default, tier 1 and tier 2 IPCC and country-specific EFs. During the technical analysis week, the TTE noted that providing references to the specific EFs applied, together with the use of notation keys in line with IPCC guidance where estimates are not provided, would enhance the transparency of the estimates for the sector.

33. For the LUCF sector, China reported GHG emissions and removals for 2012. Net removals reported for 2012 amounted to 576 Mt CO_2 eq.

34. For the waste sector, China reported emissions of 158 Mt CO_2 eq, with CH_4 from wastewater handling being the largest contributing emission source in this sector, accounting for 57.3 per cent of emissions. Emissions from waste incineration (non-energy use) were also reported, accounting for 8.9 per cent of the total emissions for the sector.

35. China included in its BUR the previously reported inventories for the years 1994 and 2005. The BUR states that the scope of these inventories is not consistent with the 2012 inventory, and that the third national communication (currently under preparation) will recalculate and update the data in the 2005 inventory to ensure better consistency in the scope and data sources. During the technical analysis, China clarified that most data for 1994 were not available for recalculation and that the official statistics data were not consistent for some sectors. In this regard, the Party could not ensure the consistency of this year with later inventories. In addition, China clarified that the "reporting year" of China's nationally appropriate mitigating actions (NAMAs) is 2005, so the time series is more useful if it starts from 2005. The TTE notes that China could consider reporting a consistent time series back to 1994 using, for example, IPCC guidance on time-series consistency further enhancing the transparency of the information reported in the BUR.

36. China described in its BUR the institutional framework for the preparation of its 2012 GHG inventory, including the key agencies involved. China reported that it has established a national system for the preparation of its GHG inventory. NDRC has the overall coordination role for the preparation of China's GHG inventory, which was prepared with input from a number of other organizations, with specific roles for the sectors included in the GHG inventory, as reported in table 2-1 of the BUR.

37. To ensure high-quality electronic management of inventory-related data, China has established a database system for the national and sectoral GHG inventories. As part of the inventory development process, China organized a number of technical workshops for researchers and experts to learn from relevant research results. As part of the quality assurance of the inventory, China invites experts that are not involved in the inventory preparation to peer review the methodologies and results. The TTE notes that China's establishment of a national system for the preparation of GHG inventories could contribute to sustainable inventory preparation. The TTE commends China for its efforts.

38. China reported the results of a key category analysis performed for the level of emissions in the 2005 inventory, which identified 51 key categories, including: CO_2 emissions from public electricity and road transport; N_2O emissions from adipic acid production; HFC-23 emissions from HFC-22 production; and CH_4 emissions from rice cultivation, solid waste disposal and carbon uptake by forests. For the key categories identified, China reports that emissions from these key categories were calculated using higher-tier methods and country-specific EFs in the 2012 GHG inventory as much as possible, and reported on methodology tiers and EFs in table 2-2 of the BUR. The BUR also provides information on quality assurance/quality control measures for the inventory as a whole. The TTE commends China for providing information in accordance with the IPCC good practice guidance.

39. China reported information on CO_2 from fuel combustion using both the sectoral and reference approaches; however, information on the difference was not reported. During

the technical analysis, China clarified that the difference between the two approaches is less than 5 per cent, which was not considered to be a significant enough difference to be reported in the BUR. The TTE noted that the transparency of the information reported would be further enhanced if this information were reported in the BUR.

40. Information was reported on international aviation and marine bunker fuels as memo items in accordance with decision 17/CP.8, annex, table 1.

41. China reported information on its use of global warming potential (GWP) values. China uses the 100-year GWPs, consistent with the IPCC in its Second Assessment Report, for all GHGs. However, for HFC-245fa, the 100-year GWP from the IPCC Fourth Assessment Report is used.

42. China reported information on the uncertainty assessment (level) of its national GHG inventory, which was based on the error propagation approach in the IPCC good practice guidance. The results obtained, as reported in the BUR, show that the overall uncertainty for the inventory was estimated at 5.4 per cent. For the energy, industrial processes, agriculture, LUCF and waste sectors, the uncertainties are estimated to be 5.5 per cent, 4.4 per cent, 21.3 per cent, 43.2 per cent and 24.0 per cent, respectively.

3. Mitigation actions and their effects, including associated methodologies and assumptions

43. As indicated in table 2, in annex I, China reported in its BUR, completely in accordance with paragraphs 11–13 of the UNFCCC reporting guidelines on BURs, information on mitigation actions and their effects, to the extent possible.

44. The information reported provides a clear and comprehensive overview of the Party's mitigation actions and their effects, including its national context. In its BUR, China frames its national mitigation planning and actions in the context of its 12th Five-Year Plan (FYP) period (2011–2015), during which time China reports that it put into force the following: the National Climate Change Programme; the Working Programme for Controlling Greenhouse Gas Emissions in the 12th Five-Year Plan; the Comprehensive Working Programme of Energy Conservation and Emissions Reductions in the 12th FYP period; the Plan for Energy Conservation, Emission Reduction and Low Carbon Development; and the National Plan on Climate Change 2014–2020. China reported that the implementation of these plans and programmes was intended to, among other things, promote energy conservation, carbon reduction and ecosystem management, control GHG emissions from non-energy activities and explore low-carbon development patterns better suited to national conditions. Most of the mitigation actions are in the energy sector, including a few cross-cutting mitigation actions. China reported that climate change has been mainstreamed and integrated into its development plans.

45. China reported a summary of its mitigation actions in tabular format. Consistent with decision 2/CP.17, annex III, paragraph 12(a), China reported mitigation actions that are linked to: energy conservation and energy efficiency for the supply and demand sectors as well as optimization of China's energy mix for power generation. Furthermore, China has a series of mitigation initiatives, such as: implementation of low-carbon development across sectors; and making use of international market mechanisms and increasing carbon sinks in the forestry sector through afforestation, greening, strengthened forest management with quantitative goals. Most of the mitigation actions reported by China cover the most common greenhouse gas (CO_2) and a few actions target fluorinated gases (e.g. HFC-23). This information, including progress indicators, on the progress of implementation is reported in the BUR, in table 3-6. A description of mitigation actions and information on quantitative goals was also reported in the BUR.

46. China reported a group of mitigation actions on energy conservation and improvement in energy efficiency facilitated by Nationwide Energy Conservation Action (NECA). Examples of some of the key mitigation actions associated with NECA include: the enterprise energy conservation and low-carbon development initiative; the boiler/kiln retrofit programme; the waste heat and pressure utilization project; the industrial energy systems optimization project; and the energy efficiency labelling project. NECA is reported to have had a cumulative emission reduction of 1.9 Gt CO_2 over a five-year period (2011–

2015) covering energy supply- and demand-side sectors with most impact being on CO_2 emissions. For some of the mitigation actions, there are similarities in terms of the nature of the actions as well as the coverage of the sectors. Information is reported on the methodologies and assumptions used to report the results achieved and to quantify the GHG emission reductions associated with this group of mitigation actions. In addition, changes in energy consumption per unit of gross domestic product (GDP) are used to quantify energy savings (e.g. table 3-1 of the BUR), which are ultimately translated into emission reductions.

47. China also reported five mitigation actions for energy mix optimization, including information on the objectives, targets, methodologies and assumptions, and information on the progress of implementation, including the steps and results achieved. These mitigation actions include developing natural gas, hydropower and wind and solar power. The estimated CO_2 emission reductions for each of the individual actions was reported and, during the technical analysis, China clarified that a total reduction was not reported because of potential double counting. As reported in the BUR, the mitigation action entitled "developing non-fossil fuels" (action 16 in table 3-6) contains reported mitigation effects of renewable energy actions which are also included in other mitigation actions such as developing wind power (action 19 in table 3-6) and solar power (action 20 in table 3-6). The Party reports that it has applied an implied emission factor (IEF) for most of its mitigation actions; however, China did not provide further information on how the IEF has been determined. During the technical analysis, China clarified that the IEF comes from the 2005 GHG inventory. The estimated emission reductions for most of the mitigation actions reported by China (No 2–17 in table 3-6) are based on the estimated progress in energy/power conservation through reduced consumption of fossil fuels. The methodologies and assumptions used for the estimation of energy/power conservation are reported in the BUR; however, further detail is not reported in the BUR. During the technical analysis, China clarified that the results achieved for some of its mitigation actions are determined by multiplying the energy/electricity savings by the IEF from the 2005 national inventory (which is calculated by dividing emissions by energy consumption). The overall IEF of electricity comes from the weighted average of the provincial-level EFs. The TTE noted that transparency could be further enhanced by describing how the IEFs reported in the BUR for all mitigation actions are developed.

48. China also reported non-energy sector related mitigation initiatives in its BUR. In its 12th FYP, China intensified its control of GHG emissions from industrial processes, agriculture and waste. For industrial processes, China described steps taken to remove and destroy HFC-23 from existing HCFC-22 production facilities by issuing the notice on "Organizing and carrying out work related to the disposal of hydrofluorocarbons" in 2015. A supplementary notice was also issued in 2015 to cover new HCFC-22 plants. China has also implemented alternative technologies to replace limestone with carbide slag in cement clinker production, treatment and destruction of N_2O from nitric acid production and adipic acid production. In the agriculture sector, China reported initiatives such as the pilot programme for a soil test-based fertilization programme, an initiative to spread the use of residue coverage, non-tillage and other protective farming technologies and cropland management systems. For the waste sector, China has developed plans for the treatment of CH_4 emissions from municipal wastewater and solid waste treatment processes, the promotion of advanced waste incineration technologies and has formulated incentive policies to advance the recycling and reuse of landfill gases. China estimates that accumulated emission reductions from non-energy related emissions will stand at more than 1.1 Gt CO_2 eq in the 13th FYP period (2016–2020).

49. China further reported a series of mitigation actions to increase its carbon sinks. The nation['] afforestation and greening plan for 2011–2020, which aims to advance afforest n and greening, has resulted in 307,000 km^2 of land afforested in the 12th FYP resulting a forest cover increase of 21.6 per cent by the end of the 12th FYP period. Through the Natural Forest Resources Conservation Programme, China has afforested 2.5 million hectares (Mha) since 2011. In an effort to manage fire-related disasters, since 2015, China has placed an area of 1.155,000 km^2 under the management and protection of the Natural Forest Resources Conservation Programme. China also reported that development

of marine blue carbon sinks is under way, with the plan to rehabilitate coastal belt ecosystems, improving water quality and developing the marine carbon sink.

50. The descriptions of the steps taken for different mitigation actions are in some cases reported collectively but the actions are reported individually in table 3-6 of the BUR. The TTE noted that this makes it difficult to analyse the extent to which the steps taken or envisaged are related to each of the mitigation actions. During the technical analysis, China clarified that although some actions are similar and overlapping, they are different in design, focus and coverage. The TTE noted that transparency of reporting could be further enhanced by including this information in the BUR. The TTE acknowledges that this is a complex area which is a challenge; and therefore, is an opportunity for capacity-building, which is captured in paragraph 93 below.

51. China provided information on its involvement in international market mechanisms as a Party to the Kyoto Protocol. Information on total projects, sectors covered and quantity of certified emission reductions (CERs) that have been issued for China and on the carbon emissions trading scheme is reported in the BUR. China also provided a link to the website[1] with a list of all its actions related to the clean development mechanism (CDM), as well as presenting the overall emission reduction impact of all its CDM projects. The BUR reports that the designated national authority for the CDM in China (NDRC) approved 2,226 CDM projects in the period 2011–2015, with 2,115 of these successfully registered with the CDM Executive Board. Together with projects approved prior to 2011, CER issuance totalled 695 Mt CO_2 eq. The information reported did not clearly indicate whether the emission reductions from some of these projects contributed to the estimated emission reductions of the mitigation actions reported in table 3-6 of the BUR. In its BUR, China indicates that its carbon emissions trading scheme is one of the key mitigation measures being implemented at the local level, and that plans are under way to elevate the implementation of this mitigation action to the national level. However, this information is not included in its list of mitigation actions in table 3-6 of the BUR. During the technical analysis, China clarified that it is extremely challenging to report information on the results achieved for its carbon emissions trading scheme and that China is conducting studies in these areas. China further indicated that this could be a very important capacity-building need (which is captured in para. 93 below) with emphasis on methodologies for quantifying the results achieved (estimated outcomes or emission reductions) of its carbon emissions trading scheme. The TTE agrees with the observation and notes that the transparency of the information reported could be enhanced if this information were included in the BUR.

52. China has reported information on its domestic MRV system, which is designed at the national level in three main areas: the BUR preparation process; the GHG inventory system; and the preparation of NAMAs, consistent with decision 2/CP.17, annex III, paragraph 13. Further, China reported additional information based on the voluntary general guidelines for domestic MRV contained in decision 21/CP.19. China reported that it has established a domestic MRV system for mitigation and outlined the steps for a proposed pathway for further enhancement, including: establishing institutional arrangements; defining mitigation accounting standards, monitoring and data collection responsibilities; defining reporting obligations; and defining verification approaches and roles. An institutional arrangement for tracking high-level indicators particularly for NECA for emission reductions is well documented in table 5-3 of the BUR. However, it is not clear how reporting and verification of the individual mitigation actions presented in table 3-6 of the BUR, in particular, is achieved. During the technical analysis, China clarified that the institutional arrangement for MRV in China is targeted at overall results achieved by all mitigation actions. Therefore, China has identified a capacity-building need, which is captured in paragraph 93 below, especially in the area of verification of results achieved for individual measures. The TTE agrees with this observation by China.

[1] See http://cdm.ccchina.org.cn/.

4. Cross-cutting domestic measurement, reporting and verification

53. As indicated in table 2 in annex I, China reported in its BUR, in accordance with paragraph 13 of the UNFCCC reporting guidelines on BURs, a description of its domestic MRV arrangements.

54. China reported that it will build upon the existing systems, processes and infrastructure, rendering it cost-effective. The domestic MRV system of China is designed at the national level and comprises three subsystems, namely: the climate change statistical indicator and basic statistics system; the GHG accounting and reporting system; and the CO_2 emission control target performance evaluation and accounting system. The statistical indicator and basic statistics system comprises 5 categories (namely: climate change and impacts; adaptation to climate change; GHG emission control; financial inputs for addressing climate change; relevant management on climate change actions), 19 subcategories and 36 specific indicators (table 5-3 of the BUR). The GHG accounting and reporting system is a three-level (national, provincial and enterprise) system for the preparation of national and provincial inventories on a regular basis. The GHG accounting and reporting system at the enterprise level covers 21 key industrial sectors, 2 transport sectors and the public building operations sector (table 5-4 of the BUR). The CO_2 emission control target performance evaluation and accounting system is also a three-level system for the monitoring and assessment of the nationwide mitigation action, the carbon intensity target and its disaggregation at provincial and enterprise level. It also covers the verification of GHG emission reports by enterprises and the verification and certification of voluntary emission reduction projects.

5. Constraints and gaps, and related technology, financial, technical and capacity-building needs, including a description of support needed and received

55. As indicated in table 3 in annex I, China reported in its BUR, completely in accordance with paragraphs 14–16 of the UNFCCC reporting guidelines on BURs, information on finance, technology and capacity-building needs and support received.

56. China reported that its main constraint is related to its limited domestic resources in terms of finance, technology and capacity-building. China reported a detailed list of six clusters of capacity-building needs in table 4-7 of the BUR, in areas related to the preparation of: its GHG inventories; a GHG statistical accounting system; adaptation to climate change; local government leadership on climate change issues; carbon trading systems; and education, training and talent cultivation.

57. China also reported an estimation of its future financial needs amounting to 30 trillion renminbi (RMB) for additional investments in the next 15 years: targeted energy conservation (RMB 20 trillion) and low-carbon development (RMB 10 trillion). The information reported indicates that continued involvement in bilateral and multilateral international cooperation is needed to cover these financial needs. During the technical analysis, China informed the TTE that these are top-down estimations and China needs capacity-building in terms of estimating the specific investment amount per economic sector, the employment rate and the co-benefits. The TTE noted that the inclusion of this information in the next BUR could further enhance the transparency of the reporting.

58. China reported a detailed list of technology needs targeting mitigation. The information provided concentrates on five sectors (namely: energy; iron and steel; transportation; building; and general technologies) covering specific needs such as integrated gasification combined cycle power generation, large-scale offshore wind power generation, hydrogen energy and fuel cell technology, smart grid and energy storage, carbon capture and storage, and high-efficiency electric vehicles. During the technical analysis, China informed the TTE that the reported technology needs have been prioritized in line with China's technology needs assessment project, its own needs and the possibility of technology provided by developed countries.

59. In the BUR, China reported that from the 2010 fiscal year to the 2014 fiscal year of the GEF, China received GEF grant commitments of approximately USD 149 million in total for 20 national climate change projects, mainly covering fields such as energy efficiency improvement, low-carbon transportation, energy-efficient buildings, low-carbon

city demonstration projects and cropland soil carbon storage. China also reported on the major support received from bilateral and multilateral international cooperation programmes for addressing both mitigation and adaptation to climate change. China indicated that it received financial support from the European Union (EU), Germany, Norway, the United Nations Development Programme (UNDP) and the World Bank. China also reported on the GEF grant received in 2015 for the preparation of the current BUR (USD 900,000).

60. Concerning the capacity-building received by China, it reported on the series of cooperation and exchange activities related to MRV and the emissions trading mechanism conducted with Australia, the EU, Norway, Sweden, the UNDP, the United States of America and the World Bank. The information reported on financial support in table 4-2 of the BUR does not cover completely the support received from bilateral and multilateral programmes for addressing climate change. During the technical analysis, China informed the TTE that, owing to incomplete statistics and because there are many sectors, departments and countries involved in bilateral and multilateral programmes, it is very difficult to obtain the full picture of the respective financial support received, and China's current climate statistics system has not yet covered this aspect. China informed the TTE that the information on support received from non-governmental organizations and the private sector is very scattered and fragmented, and there is also a lack of statistical basis. China also indicated that at this time its priority is improving its ability to report information on public-sector finance. The TTE noted that the inclusion of this information in the next BUR could further enhance the transparency of the reporting.

61. Regarding the future needs for addressing climate change, China has indicated that this would enable China to fulfil its self-initiated 2030 GHG emission control targets and to implement the 15 key actions outlined in its NDC (see para. 20 above). These financial needs would require domestic investment from government, private sector and social groups, as well as from bilateral and multilateral international cooperation channels.

62. China reported on its participation in a number of international initiatives for technology cooperation (e.g. the Electric Vehicle Initiative, the Carbon Sequestration Leadership Forum, the International Smart Grid Action Network, the International Partnership for Hydrogen and Fuel Cells in the Economy and Mission Innovation) and bilateral cooperation with the EU, Germany, the Republic of Korea, the United Kingdom of Great Britain and Northern Ireland and the United States. China also reported, in table 4-4 of the BUR, detailed information about the technology cooperation under the China-US Climate Change Working Group. However, although China reported that there were also bilateral technology cooperation arrangements between China and the EU, Germany, the Republic of Korea and the United Kingdom, no detailed information was provided about these arrangements. During the technical analysis, China informed the TTE that technical cooperation with countries other than the United States has been mainly concentrated in energy and other areas, instead of climate-specific technologies. The technology cooperation on climate change mainly focus on carbon dioxide capture and storage (CCS) and carbon capture, utilization and storage (CCUS), with the EU, the Republic of Korea and the United Kingdom. The EU and the United Kingdom proposed to support the construction of a CCUS demonstration project in China. China and the Republic of Korea agreed to cooperate in the field of CCS to promote exchanges through sharing experiences and holding technical seminars. The TTE noted that the inclusion of this information in the next BUR could further enhance the transparency of the reporting.

63. During the technical analysis, China further clarified that the reported support in the BUR is mainly focused not only on climate change capacity-building projects, but also energy- and climate-related areas such as energy conservation and renewable energy demonstration projects. During the technical analysis week, China clarified that the compilation of tables 4-1 and 4-2 in the BUR is a collective effort undertaken by various ministries guided by NDRC. Only projects that are climate-related or contain some climate change related elements are included. The TTE noted that the inclusion of this information in the next BUR and a short description of the projects listed in tables 4-1 and 4-2 of the BUR could further enhance the transparency of the reporting.

6. Any other information

64. China reported information in its BUR on its efforts at South–South cooperation. During the period 2011–2015, China reported that it has engaged in a broad range of cooperation activities with nearly 100 developing countries across Asia, Africa, Latin America and the South Pacific region, in the following areas: renewable energy; emergency response; meteorological satellite monitoring; clean development and utilization; agriculture, forest and wild life protection; water resource use and management and desertification; and clean energy and environmental projects. These included technical assistance, technology transfer cooperative mechanisms and training programmes. As it relates to South–South cooperation for small island developing States (such as Antigua and Barbuda, Barbados, Maldives, Samoa and Tonga), memorandums of understanding were signed, based on their specific needs. Further, China provides financial assistance to some countries (see para. 65 below). China has also spent USD 6 million to support the United Nations Secretary General's efforts to promote South–South cooperation in climate change. China also signed a memorandum of understanding on "the donation of in in-kind for the purpose of climate change" with 24 developing countries; in this regard, China has provided energy-saving lamps and air conditions units, photovoltaic street lights and power generation systems and other low-carbon products.

65. China reported that at the Conference of the Parties in Paris, in November 2015, President Xi Jinping announced the establishment of the China South-South Cooperation Fund on Climate Change with a contribution of RMB 20 billion yuan. He also announced the launch of a new initiative called the Ten-Hundred-Thousand Project to commence in 2016 which, among other things, includes actions such as implementing 10 low-carbon demonstration projects, 100 climate change mitigation and adaptation projects in developing countries and providing 1000 people with training in climate change. China provides financial, technical and capacity-building support and has developed implementation plans and launched some projects. The TTE commends China for playing a key role in implementing these activities in support of developing countries' response to climate change.

66. China reported in the BUR information on: its climate observation system, focusing on atmospheric, marine and ecological observation, and the related gaps and prospects; advances in climate change research, in particular indicating research studies that have been performed in China about global climate change observations, laws and mechanisms, impacts and adaptation to climate change, and the development of low-carbon technology; adaptation actions in vulnerable areas such as agriculture, forestry, urban areas, water resources, coastal areas and relevant seas; disaster forecasting and early warning systems; a list of technology needs for adaptation concentrated on five sectors including observation, numerical prediction, agriculture, coastal zone protection and ecosystems; education, outreach and public awareness, in order to mobilize multiple channels and adopt various measures to encourage all citizens to take actions against climate change; and international exchanges and the cooperation of the Chinese Government with other governments, international organizations and international agencies.

7. Technical analysis of the information reported for the Hong Kong Special Administrative Region and the Macao Special Administrative Region

67. In addition, as encouraged in decision 17/CP.8, annex, paragraph 4, China provided a summary of relevant information regarding its national circumstances in tabular format for HKSAR and Macao SAR. China described in its first BUR the existing institutional arrangements relevant to the preparation of its national communications and BURs on a continuous basis for both HKSAR and Macao SAR.

(a) Hong Kong Special Administrative Region

68. HKSAR is described as a highly urbanized economy based on tertiary industries such as merchandise trade, with a dense population of 7.242 million. According to China, the region has a mild climate, is vulnerable to the impacts of extreme weather and has vast areas designated as protected areas.

69. The information reported in the BUR for the GHG inventory of HKSAR uses a combination of methodologies from the Revised 1996 IPCC Guidelines and the 2006 IPCC Guidelines, using EFs based on the circumstances of HKSAR to the extent possible.

70. For HKSAR, the BUR indicated that the shares of emissions that different sectors contributed to the total GHG emissions in 2012 are: energy sector, 90.6 per cent; industrial processes, 3.9 per cent; agriculture, 0.1 per cent; and waste 5.4 per cent.

71. Notation keys are used in some sectors; for example "NE" is reported for CH_4 and N_2O emissions from industrial processes. The TTE was not able to fully understand the information reported, and as such, the TTE notes that the transparency of the reporting could be improved if a brief explanation on the use of the notation key "NE" were to be provided according to the reporting guidelines contained in decision 17/CP.8, annex, chapter III (National greenhouse gas inventories). Information is not reported in accordance with table 1 of the above-mentioned reporting guidelines. During the technical analysis, the Party clarified that because only cement production occurred in HKSAR it did not provide the disaggregated data for IPPU. The TTE noted that the transparency of the information reported on emissions and removals could be further enhanced by applying a notation key to each specific emission source or removal in the next BUR.

72. In 2012, the total GHG emissions for HKSAR including and excluding LUCF were reported as 42.7 Mt CO_2 eq and 43.2 Mt CO_2 eq respectively, with the most significant emissions being CO_2 amounting to 39.6 Mt (91.7 per cent).

73. The GHG inventories for HKSAR for 1994 and 2005 are included in the BUR; however, the Party has reported that the inventory for 2005 is to be updated for the third national communication. In 1994 the total emissions including and excluding LUCF were reported as 35.3 Mt CO_2 eq and 35.7 Mt CO_2 eq, respectively. In 2005, total emissions including and excluding LUCF were 41.2 Mt CO_2 eq and 41.6 Mt CO_2 eq, respectively.

74. Emissions from international bunker fuels (marine and aviation) are reported as memo items in table 7-3 of the BUR. In addition, table 7-3 includes special regional aviation and marine emissions as memo items and the BUR states that these emissions are included in the GHG inventory for mainland China as emissions from domestic aviation and navigation. The uncertainty of the HKSAR inventory is estimated as 4.3 per cent using the error propagation method in the IPCC good practice guidance.

75. In its BUR, China reports that, similar to national actions, HKSAR has demonstrated its support for mitigating climate change by efforts promoting green and low-carbon communities, and effectively managing GHG emissions through various policies and measures, which include: revamping the fuel mix for power generation; improving energy efficiency; promoting green road transport; promoting the use of cleaner fuel in vehicles; turning waste into energy; and tree planting. The Party also reported that from 2005 to 2012 Hong Kong's GHG emissions per capita remained at 6.0 t CO_2 eq, while the CO_2 emissions per unit GDP dropped by around 20 per cent. The Party reported a summary of its mitigation actions for HKSAR in tabular format in a manner that is consistent with decision 2/CP.17, annex III, paragraph 12(a).

76. Eight mitigation actions were reported for HKSAR in table 7-7 of the BUR: five in the area of energy efficiency and three in the area of waste into energy. In addition, a number of other mitigation actions, including actions on transport and tree planting and urban greening were provided in the text of chapter 3 of part 7 of the BUR but not in table 7-7. Consistent with decision 2/CP.17, annex III, paragraphs 12(b–d), the Party provided in table 7-7 and chapter 3 of part 7 of the BUR information on methodologies and assumptions, objectives of the action, steps taken or envisaged to achieve that action, and information on the progress of implementation of the mitigation action. HKSAR reported mitigation actions in the area of energy efficiency and waste to energy, in table 7-7 of the BUR. Emission reductions from energy efficiency related actions are quantified by multiplying the energy saved by grid EFs. Emission reductions from waste-to-energy actions are quantified by multiplying the amount of alternative fossil energy by EFs for those fuels. The estimated CO_2 emission reductions for each of the individual energy efficiency actions was reported, contributing a total of 3,542 kt CO_2 per year. The only

waste-to-energy action under implementation, which is the dedicated sludge treatment facility, realized emission reductions of 260 kt CO_2 eq per year.

77. Information on international market mechanisms is also reported for HKSAR. According to the information reported, the Environmental Protection Department of Hong Kong has, since 2009, issued 73 letters of certification for HKSAR enterprises and of this number, 50 projects were approved by NDRC, 48 of which have been registered with the United Nations. These projects include wind power, hydropower, reuse of waste heat, solar power, biomass thermal energy and waste combustion.

78. In addition, consistent with decision 2/CP.17, annex III, paragraph 13, China has reported information on the description of domestic MRV arrangements for HKSAR. The secretariat of the Interdepartmental Working Group on Climate Change is responsible for consolidating and recording the progress of mitigation actions taken by bureaux and relevant departments.

79. Information is reported for the HKSAR region on the need for funding to support GHG inventory compilation, the organization of seminars and workshops on capacity-building, implementation of mitigation actions and adaptation measures, and participation in international conferences. HKSAR also identified its capacity-building and technology needs in the report.

(a) Macao Special Administrative Region

80. Macao SAR is described as having a mild climate and limited natural resources; the region is also described as being vulnerable to the impacts of extreme weather with extremely limited land resources. This region is experiencing rapid economic development; tourism and real estate are the main economic drivers. This region is reported as having very high population densities, with a total population of 636,000.

81. The information reported in the BUR for the GHG inventory for Macao SAR uses a combination of methodologies and EFs from the Revised 1996 IPCC Guidelines and the 2006 IPCC Guidelines.

82. In 2012, total emissions for Macao SAR amounted to 978 kt CO_2 eq excluding LUCF. Emissions for LUCF are reported as "NE". In Macao SAR, in 2012, the energy sector contributed 97.6 per cent of total emissions and the waste sector contributed 2.4 per cent. Emissions for the industrial processes and agriculture sectors are reported as "NO" (not occurring), and for the LUCF sector, CO_2 and N_2O are reported as "NE", and CH_4 as "NO". The TTE was not able to fully understand the information reported, and as such, the TTE notes that the transparency of the reporting could be improved if a brief explanation on the use of the notation key "NE" were to be provided according to the reporting guidelines contained in decision 17/CP.8, annex, chapter III (National greenhouse gas inventories). GHG inventory information is not reported in accordance with table 1 of the above-mentioned reporting guidelines. During the technical analysis, the Party explained that all the information which was not disaggregated was on emissions that were not estimated or did not occur in Macao. The TTE noted that the transparency of the information reported on emissions and removals could be further enhanced by applying a notation key to each specific emission source or removal in the next BUR.

83. The GHG emissions reported for Macao SAR for 2012, excluding LUCF, include CO_2 amounting to 939 kt CO_2 eq (96.0 per cent), CH_4 amounting to 5 kt CO_2 eq (0.5 per cent), and N_2O amounting to 34 kt CO_2 eq (3.5 per cent). Information reported in the BUR indicates that HFCs, PFCs and SF_6 are excluded from Macao's GHG inventory due to lack of data.

84. The BUR does not contain a GHG inventory summary table for Macao SAR for the previously reported year (2005), but states that total GHG emissions in 2005 were 1.8 Mt CO_2 eq, and in 2012, emissions have decreased by 45.8 per cent relative to 2005. An increase in outsourced electricity generation resulting in lower emissions from local energy activities was identified as the main reason for this reduction.

85. Emissions from international bunker fuels (marine and aviation) are reported as memo items in table 8-2 of the BUR. In addition, table 8-2 includes special regional

aviation and marine emissions as memo items and the BUR states that these emissions are included in the GHG inventory for mainland China as emissions from domestic aviation and navigation.

86. The uncertainty of the Macao SAR inventory is estimated to be 3.3 per cent using the tier 1 approach in the IPCC good practice guidance, and taking into account the EF uncertainty estimation approach in the Revised 1996 IPCC Guidelines and the 2006 IPCC Guidelines.

87. In its BUR, China reports that Macao SAR frames its national mitigation planning and actions of building a low-carbon Macao "creating green living together" to actively support and synergize with national policies and actions in addressing climate change. According to mainland China, Macao SAR's target for GHG emission control is to reduce GHG emissions per unit of GDP by 40–45 per cent relative to the 2005 level by 2020.

88. The Party reported a summary of its mitigation actions for Macao SAR in tabular format. Consistent with decision 2/CP.17, annex III, paragraph 12(a), China reported the names and descriptions of the mitigation actions, including information on the nature of the action, coverage (sectors and gases), quantitative/qualitative goals and progress indicators for Macao SAR in table 8-3 and chapter 3.2 of part 8 of the BUR.

89. Six mitigation actions were reported for Macao SAR in table 8-3, all of which were in the energy sector, including transport; one of these actions was reported as also having an impact on the waste sector. In addition, a number of other mitigation actions, including actions on urban greening, were reported in the text of chapter 3.2 of part 8 of BUR but not listed in table 8-3. Consistent with decision 2/CP.17, annex III, paragraphs 12(b–d), the Party provided information on methodologies and assumptions, objectives of the actions, steps taken or envisaged to achieve that action, and information on the progress of implementation of the mitigation in table 8-3 and chapter 3.2 of Part 8 of the BUR. Key mitigation actions for Macao SAR include: the gradual increase of the share of natural gas; promoting the use of environmentally friendly vehicles; and introducing an energy-saving products and equipment subsidy scheme. The results achieved for Macao SAR, in terms of the estimated GHG emission reductions, for its mitigation actions were also reported. The mitigation action with the highest estimated emission reduction impact for Macao SAR is "Gradual increase of share of natural gas", amounting to a total reduction of 188.4 kt of CO_2 for the period 2008–2014. The energy-saving products and equipment subsidy scheme was estimated to result in an emission reduction of 41 kt CO_2 for the period 2011–2015; while the action on promoting the use of environmentally friendly vehicles was estimated as realizing an emission reduction of 14.7 kt CO_2 for the period 2012–2015.

90. China did not report information on international market mechanisms for enterprises from Macao SAR. During the technical analysis, the Party clarified that currently there are no projects under international market mechanisms for Macao SAR.

91. Consistent with decision 2/CP.17, annex III, paragraph 13, China has reported information on domestic MRV arrangements for Macao SAR. In table 8-3 of the BUR, information is also reported on the institutions that are involved in the supervision of its mitigation actions listed in this table. Further, China reported that an MRV mechanism for mitigation actions with significant mitigation potential still needs to be established, including guidelines and user manuals to improve the understanding and implementation of mitigation actions, by the relevant institutions and personnel.

D. Identification of capacity-building needs

92. In consultation with China, the TTE identified the following capacity-building needs related to the facilitation of the preparation of subsequent BURs and participation in ICA:

(a) Enhance national capacity to use the 2006 IPCC Guidelines in China's national GHG inventory, if enhanced capacity is necessary to use the updated guideline;

(b) Regarding mitigation actions, enhancing national capacity to:

(i) Identify and use methodologies for quantifying the results achieved (estimated outcomes or emission reductions);

(ii) Develop methodologies and approaches to enable the disaggregation of the overlaps in the assessment of mitigation actions and their effects;

(c) Develop methodologies (e.g. cost–benefit analysis) to estimate specific investment amounts per sector and/or type of mitigation action;

(d) Compile and synthesize information on methodologies and experiences from other Parties for tracking climate-related financial support received through different channels in order to enhance China's ability to obtain and report the full picture of financial support received, starting with the support received by the public sector;

(e) Perform verification of estimated emission reductions for single mitigation actions.

93. The TTE noted that, in addition to those identified during the technical analysis, China reported a number of capacity-building needs in table 4-7 of the BUR, covering the following sectors:

(a) GHG inventory preparation;

(b) GHG statistical accounting system;

(c) Adaptation to climate change;

(d) Local government leadership on climate change issues;

(e) Carbon emissions trading system;

(f) Education, training and talent cultivation.

94. China also reports on its plans for building capacity to improve public awareness and the MRV system at local and regional levels, and identifies capacity-building needs for HKSAR and Macao SAR, including for the preparation of the GHG inventory, mitigation actions and their effects.

III. Conclusions

95. The TTE conducted a technical analysis of the information reported in the first BUR of China in accordance with the UNFCCC reporting guidelines on BURs. The TTE concludes that the reported information is mostly consistent with the UNFCCC reporting guidelines on BURs and provides an overview of: national circumstances and institutional arrangements relevant to the preparation of national communications on a continuous basis; the national inventory of anthropogenic emissions by sources and removal by sinks of all GHGs not controlled by the Montreal Protocol; mitigation actions and their effects, including associated methodologies and assumptions; constraints and gaps, and related financial, technical and capacity-building needs, including a description of support needed and received; the level of support received to enable the preparation and submission of BURs; domestic MRV; and other information relevant to the achievement of the objective of the Convention including climate change research and adaptation actions. The TTE concluded that the information analysed is mostly transparent. China's first BUR also includes the above information for HKSAR and Macao SAR.

96. China reported information on the institutional arrangements relevant to the preparation of BURs. The National Leading Group on Climate Change, Energy Conservation and Emission Reduction, established by the Chinese Government in 2007, performs the dual roles of national deliberation and coordination and also reviewed and submitted China's NDC. The Leading Group Office is based at NDRC, with the participation of ministerial members including the Ministry of Foreign Affairs, Ministry of Environmental Protection and Ministry of Finance. It has taken significant steps to create institutional arrangements that allow for the sustainable preparation of BURs. These include organizational improvements and knowledge-sharing procedures to facilitate information transfer from the regional and enterprise levels. The TTE commends China for

the progress made and noted that the plans to improve the overall MRV system of GHG emissions and reductions, as outlined in its BUR, would contribute to achieving sustainable reporting to the secretariat and enhancing the transparency of information reported in the BUR.

97. In its first BUR, submitted in 2016, China reported information on its national GHG inventory for the years 1994, 2005 and 2012. This included GHG emissions and removals of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 for all relevant sources and sinks. The inventory was developed using a combination of the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the 2006 IPCC Guidelines. China uses both country-specific and IPCC default EFs. The total GHG emissions for 2012 were reported as 11,896 Mt CO_2 eq (excluding LUCF) and 11,320 Mt CO_2 eq (including LUCF). The energy sector and CO_2 are the largest contributing sector and the main gas in China's GHG inventory.

98. China reported information on mitigation actions and their effects, including the mitigation goal of each action. These mitigation actions were categorized in the context of groups of actions as: energy conservation and improvement of energy efficiency; energy mix optimization; and emission control in the non-energy sectors. The following estimated GHG emission reductions were reported for the groups: energy conservation and improvement in energy efficiency, cumulative GHG emission reductions amounting to 1.9 Gg CO_2 for the period 2011–2015; energy mix optimization related mitigation actions such as developing natural gas (520 Mt CO_2), increase use of non-fossil fuels (1,750 Mt CO_2) and large-scale hydropower and renewable energies for the period 2006–2015.

99. China reported information on key constraints, gaps and related needs, identifying as the main constraint its limited domestic resources in terms of finance, technology and capacity-building. As indicated in table 3 in annex I, China reported in its BUR, complete information on finance, technology and capacity-building needs and support received. China also reported that continued involvement in bilateral and multilateral international cooperation is needed to cover its future financial needs, which are estimated to be RMB 30 trillion for additional investments in the next 15 years targeting energy conservation and low-carbon development.

100. The TTE, in consultation with China, identified five[2] capacity-building needs related to the facilitation of reporting in accordance with the UNFCCC reporting guidelines on BURs and to participation in ICA in accordance with the ICA modalities and guidelines, taking into account Article 4, paragraph 3, of the Convention. China prioritized these as the capacity-building needs.

[2] This refers to the number of capacity-building needs listed in chapter II.D above.

Annex I

Extent of the information reported by China in its first biennial update report

Table 1
Identification of the extent to which the elements of information on greenhouse gases are included in the first biennial update report of China

Decision	*Provision of the reporting guidelines*	*Yes Partly No NA*	*Comments on the extent of the information provided*
Decision 2/CP.17, paragraph 41(g)	The first BUR shall cover, at a minimum, the inventory for the calendar year no more than four years prior to the date of the submission, or more recent years if information is available, and subsequent BURs shall cover a calendar year that does not precede the submission date by more than four years	Yes	China submitted its first BUR in January 2017, although it has a publication date of December 2016; the GHG inventories reported are for 1994, 2005 and 2012
Decision 2/CP.17, annex III, paragraph 4	Non-Annex I Parties should use the methodologies established by the latest UNFCCC guidelines for the preparation of national communications from non-Annex I Parties approved by the COP or those determined by any future decision of the COP on this matter	Yes	China used a combination of the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the 2006 IPCC Guidelines
Decision 2/CP.17, annex III, paragraph 5	The updates of the sections on the national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol should contain updated data on activity levels based on the best information available using the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF; any change to the emission factor may be made in the subsequent full national communication	Partly	In the BUR, China reports information where EFs have changed in the 2012 inventory compared with the 2005 inventory, and the 2005 AD on energy consumption were also revised. China also reported that the data for the 2005 GHG inventory will be recalculated in its third national communication
Decision 2/CP.17, annex III, paragraph 6	Non-Annex I Parties are encouraged to include, as appropriate and to the extent that capacities permit, in the inventory section of the BUR:		
	(a) Tables included in annex 3A.2 to the IPCC good practice guidance for LULUCF	No	Comparable information was not reported
	(b) The sectoral report tables annexed to the Revised 1996 IPCC Guidelines	Partly	Sectoral report tables are not included but comparable data is reported for some sector-level AD, such as for the industrial processes,

Decision	*Provision of the reporting guidelines*	*Yes Partly No NA*	*Comments on the extent of the information provided*
			agriculture and waste sectors; however, information is not reported for the energy, solvent and other product use and LUCF sectors
Decision 2/CP.17, annex III, paragraph 7	Each non-Annex I Party is encouraged to provide a consistent time series back to the years reported in the previous national communications	Partly	The BUR reported GHG inventories for 1994, 2005 and 2012. The time series reported in the BUR did not include the years 1995–2004 and 2006–2011; and the inventories 2005 and 1994 are not consistent with the 2012 inventory because their scope is different
Decision 2/CP.17, annex III, paragraph 8	Non-Annex I Parties that have previously reported on their national GHG inventories contained in their national communications are encouraged to submit summary information tables of inventories for previous submission years (e.g. for 1994 and 2000)	Yes	This information is reported for the national inventories for the years 1994 and 2005, as reported in China's first and second national communication
Decision 2/CP.17, annex III, paragraph 9	The inventory section of the BUR should consist of a national inventory report as a summary or as an update of the information contained in decision 17/CP.8, annex, chapter III (National greenhouse gas inventories), including:		
	(a) Table 1 (National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors)	Partly	The Solvent and other product use sector and the category prescribed burning of savannahs in the agriculture sector are not included in table 2-9 of the BUR
	(b) Table 2 (National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6)	Yes	
Decision 2/CP.17, annex III, paragraph 10	Additional or supporting information, including sector-specific information, may be supplied in a technical annex	NA	
Decision 17/CP.8, annex, paragraph 13	Non-Annex I Parties are encouraged to describe procedures and arrangements undertaken to collect and archive data for the preparation of national GHG inventories, as well as efforts to make this a continuous process, including information on the role of the institutions involved	Yes	

Decision	*Provision of the reporting guidelines*	*Yes Partly No NA*	*Comments on the extent of the information provided*
Decision 17/CP.8, annex, paragraph 14	Each non-Annex I Party shall, as appropriate and to the extent possible, provide in its national inventory, on a gas-by-gas basis and in units of mass, estimates of anthropogenic emissions of:		
	(a) CO_2	Yes	
	(b) CH_4	Yes	
	(c) N_2O	Yes	
Decision 17/CP.8, annex, paragraph 15	Non-Annex I Parties are encouraged, as appropriate, to provide information on anthropogenic emissions by sources of:		
	(a) HFCs	Yes	
	(b) PFCs	Yes	
	(c) SF_6	Yes	
Decision 17/CP.8, annex, paragraph 16	Non-Annex I Parties are encouraged, as appropriate, to report on anthropogenic emission by sources of other GHGs, such as:		
	(a) CO	No	
	(b) NO_x	No	
	(c) NMVOCs	No	
Decision 17/CP.8, annex, paragraph 17	Other gases not controlled by the Montreal Protocol, such as SO_x, included in the Revised 1996 IPCC Guidelines may be included at the discretion of the Parties	No	
Decision 17/CP.8, annex, paragraph 18	Non-Annex I Parties are encouraged, to the extent possible, and if disaggregated data are available, to estimate and report CO_2 fuel combustion emissions using both the sectoral and the reference approach, and to explain any large differences between the two approaches	Partly	CO_2 emissions were calculated using the sectoral approach and verified with the reference approach, but information was not reported on any difference between these two approaches
Decision 17/CP.8, annex, paragraph 19	Non-Annex I Parties should, to the extent possible, and if disaggregated data are available, report emissions from international aviation and marine bunker fuels separately in their inventories		
	(a) International aviation	Yes	
	(b) Marine bunker fuels	Yes	
Decision	Non-Annex I Parties wishing to	Yes	China used the GWPs provided in

Decision	*Provision of the reporting guidelines*	*Yes Partly No NA*	*Comments on the extent of the information provided*
17/CP.8, annex, paragraph 20	report on aggregated GHG emissions and removals expressed in CO_2 eq should use the GWP provided by the IPCC in its Second Assessment Report based on the effects of GHGs over a 100-year time-horizon		the IPCC Second Assessment Report for all GHGs except HFC-245fa, where the GWP provided in the IPCC Fourth Assessment Report is used
Decision 17/CP.8, annex, paragraph 21	Non-Annex I Parties are encouraged to provide information on methodologies used in the estimation of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol, including a brief explanation of the sources of emission factors and activity data. If non-Annex I Parties estimate anthropogenic emissions and removals from country-specific sources and/or sinks that are not part of the Revised 1996 IPCC Guidelines, they should explicitly describe the source and/or sink categories, methodologies, emission factors and activity data used in their estimation of emissions, as appropriate. Parties are encouraged to identify areas where data may be further improved in future communications through capacity-building:		
	(a) Information on methodologies used in the estimation of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol	Yes	China used a combination of the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the 2006 IPCC Guidelines
	(b) Explanation of the sources of emission factors	Yes	China used IPCC default EFs and country-specific EFs where available
	(c) Explanation of the sources of activity data	Yes	
	(d) If non-Annex I Parties estimate anthropogenic emissions and removals from country-specific sources and/or sinks that are not part of the Revised 1996 IPCC Guidelines, they should explicitly describe:	NA	
	(i) Source and/or sink categories		
	(ii) Methodologies		

Decision	*Provision of the reporting guidelines*	*Yes Partly No NA*	*Comments on the extent of the information provided*
	(iii) Emission factors		
	(iv) Activity data		
	(e) Parties are encouraged to identify areas where data may be further improved in future communications through capacity-building	Yes	
Decision 17/CP.8, annex, paragraph 22	Each non-Annex I Party is encouraged to use tables 1 and 2 of the guidelines annexed to decision 17/CP.8 in reporting its national GHG inventory, taking into account the provisions established in paragraphs 14–17. In preparing those tables, Parties should strive to present information which is as complete as possible. Where numerical data are not provided, Parties should use the notation keys as indicated	Yes	Notation keys were used where necessary
Decision 17/CP.8, annex, paragraph 24	Non-Annex I Parties are encouraged to provide information on the level of uncertainty associated with inventory data and their underlying assumptions, and to describe the methodologies used, if any, for estimating these uncertainties:		
	(a) Level of uncertainty associated with inventory data	Yes	
	(b) Underlying assumptions	No	
	(c) Methodologies used, if any, for estimating these uncertainties	Yes	

Note: The parts of the "UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention" on reporting information on GHG emissions by sources and removals by sinks in BURs are contained in decision 2/CP.17, paragraph 41(g), and paragraphs 3–10. Further, as per paragraph 3 of those guidelines, Parties not included in Annex I to the Convention (non-Annex I Parties) are to submit updates of their national GHG inventories in accordance with paragraphs 8–24 of the "Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention", contained in the annex to decision 17/CP.8. The scope of such updates should be consistent with the non-Annex I Party's capacity and time constraints and the availability of its data, as well as the level of support provided by developed country Parties for biennial update reporting.

Abbreviations: AD = activity data, BUR = biennial update report, COP = Conference of the Parties, EF = emission factor, GHG = greenhouse gas, GWP = global warming potential, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, LUCF = land-use change and forestry, NA = not applicable, non-Annex I Parties = Parties not included in Annex I to the Convention, NMVOC = non-methane volatile organic compound, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

Table 2
Identification of the extent to which the elements of information on mitigation actions are included in the first biennial update report of China

Decision	*Provision of the reporting guidelines*	*Yes / Partly / No*	*Comments on the extent of the information provided*
Decision 2/CP.17, annex III, paragraph 11	Non-Annex I Parties should provide information, in a tabular format, on actions to mitigate climate change, by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol	Yes	
Decision 2/CP.17, annex III, paragraph 12	For each mitigation action or group of mitigation actions, including, as appropriate, those listed in document FCCC/AWGLCA/2011/INF.1, developing country Parties shall provide the following information to the extent possible:		
	(a) Name and description of the mitigation action, including information on the nature of the action, coverage (i.e. sectors and gases), quantitative goals and progress indicators	Yes	
	(b) Information on:		
	(i) Methodologies	Yes	
	(ii) Assumptions	Yes	
	(c) Information on:		
	(i) Objectives of the action	Yes	
	(ii) Steps taken or envisaged to achieve that action	Yes	
	(d) Information on the:		
	(i) Progress of implementation of the mitigation actions	Yes	
	(ii) Progress of implementation of the underlying steps taken or envisaged	Yes	
	(iii) Results achieved, such as estimated outcomes (metrics depending on type of action) and estimated emission reductions, to the extent possible	Yes	
	(e) Information on international market mechanisms	Yes	
Decision 2/CP.17, annex III, paragraph 13	Parties should provide information on the description of domestic measurement, reporting and verification arrangements	Yes	

Note: The parts of the UNFCCC reporting guidelines on BURs on the reporting of information on mitigation actions in BURs are contained in decision 2/CP.17, annex III, paragraphs 11–13.

Abbreviation: non-Annex I Parties = Parties not included in Annex I to the Convention.

Table 3
Identification of the extent to which the elements of information on finance, technology and capacity-building needs and support received are included in the first biennial update report of China

Decision	*Provision of the reporting requirements*	*Yes Partly No*	*Comments on the extent of the information provided*
Decision 2/CP.17, annex III, paragraph 14	Non-Annex I Parties should provide updated information on:		
	(a) Constraints and gaps	Yes	
	(b) Related financial, technical and capacity-building needs	Yes	
Decision 2/CP.17, annex III, paragraph 15	Non-Annex I Parties should provide:		
	(a) Information on financial resources received	Yes	
	(b) Information on technology transfer	Yes	
	(c) Information on capacity-building received	Yes	
	(d) Information on technical support received from the Global Environment Facility, Parties included in Annex II to the Convention and other developed country Parties, the Green Climate Fund and multilateral institutions for activities relating to climate change, including for the preparation of the current biennial update report	Yes	
Decision 2/CP.17, annex III, paragraph 16	With regard to the development and transfer of technology, non-Annex I Parties should provide information on:		
	(a) Technology needs, which are nationally determined	Yes	
	(b) Technology support received	Yes	

Note: The parts of the UNFCCC reporting guidelines on BURs on the reporting of information on finance, technology and capacity-building needs and support received in BURs are contained in decision 2/CP.17, annex III, paragraphs 14–16.

Abbreviation: non-Annex I Parties = Parties not included in Annex I to the Convention.

Annex II

Documents and information used during the technical analysis

Reference documents

Intergovernmental Panel on Climate Change. 1997. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. JL Houghton, LG Meira Filho, B Lim, et al. (eds.). Paris: Intergovernmental Panel on Climate Change/Organisation for Economic Co-operation and Development/International Energy Agency.
Available at https://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html.

Intergovernmental Panel on Climate Change. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. J Penman, D Kruger, I Galbally, et al. (eds.). Hayama, Japan: Intergovernmental Panel on Climate Change/Organisation for Economic Co-operation and Development/International Energy Agency/Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/gp/english/.

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Available at http://www.ipcc-nggip.iges.or.jp/public/2006gl.

"Composition, modalities and procedures of the team of technical experts for undertaking the technical analysis of biennial update reports from Parties not included in Annex I to the Convention". Annex to decision 20/CP.19. Available at
http://unfccc.int/resource/docs/2013/cop19/eng/10a02.pdf#page=12.

"Modalities and guidelines for international consultation and analysis". Annex IV to decision 2/CP.17. Available at
http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf.

"UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention". Annex III to decision 2/CP.17. Available at
http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf.

"Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention". Annex to decision 17/CP.8. Available at
http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2.

First biennial update report of China. Available at
http://unfccc.int/8722.php.

First and second national communications of China. Available at
http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php.